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[54] **FRANGIBLE BUFFER APPARATUS FOR VEHICLES**

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[52] **U.S. Cl.** ..... **293/1,** 188/1 C, 206/46 FR, 213/1 A, 213/221, 267/139, 267/162, 293/89

[51] **Int. Cl.** **B60r 19/02,** B61g 11/16, F16f 7/12

[58] **Field of Search** ..... 188/1 C; 213/1 A, 221; 293/1, 19, 71 P, 89; 206/46 FR

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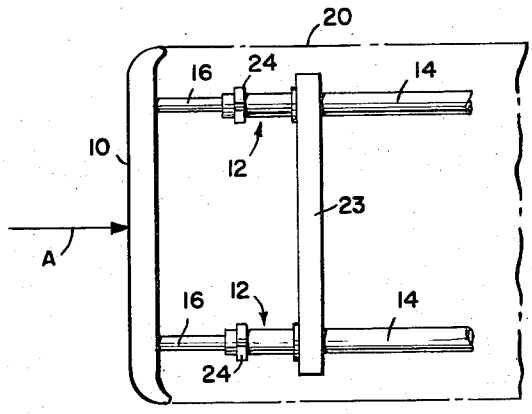
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[57] **ABSTRACT**

An impact absorbing bumper apparatus for motor vehicles in which the bumper is supported on telescoping legs extending from the vehicle, the legs retracting in response to the application of an impact load to the bumper. The retracting movement of the legs is resisted by an energy absorbing means comprising a replaceable cartridge made of a crushable material. A shiftable plate assembly is positioned in the legs. After impact forces have crushed the cartridge, the legs are disassembled to provide access to the shiftable plate assembly for removal of the crushed cartridge and replacement with a new cartridge.

8 Claims, 3 Drawing Figures



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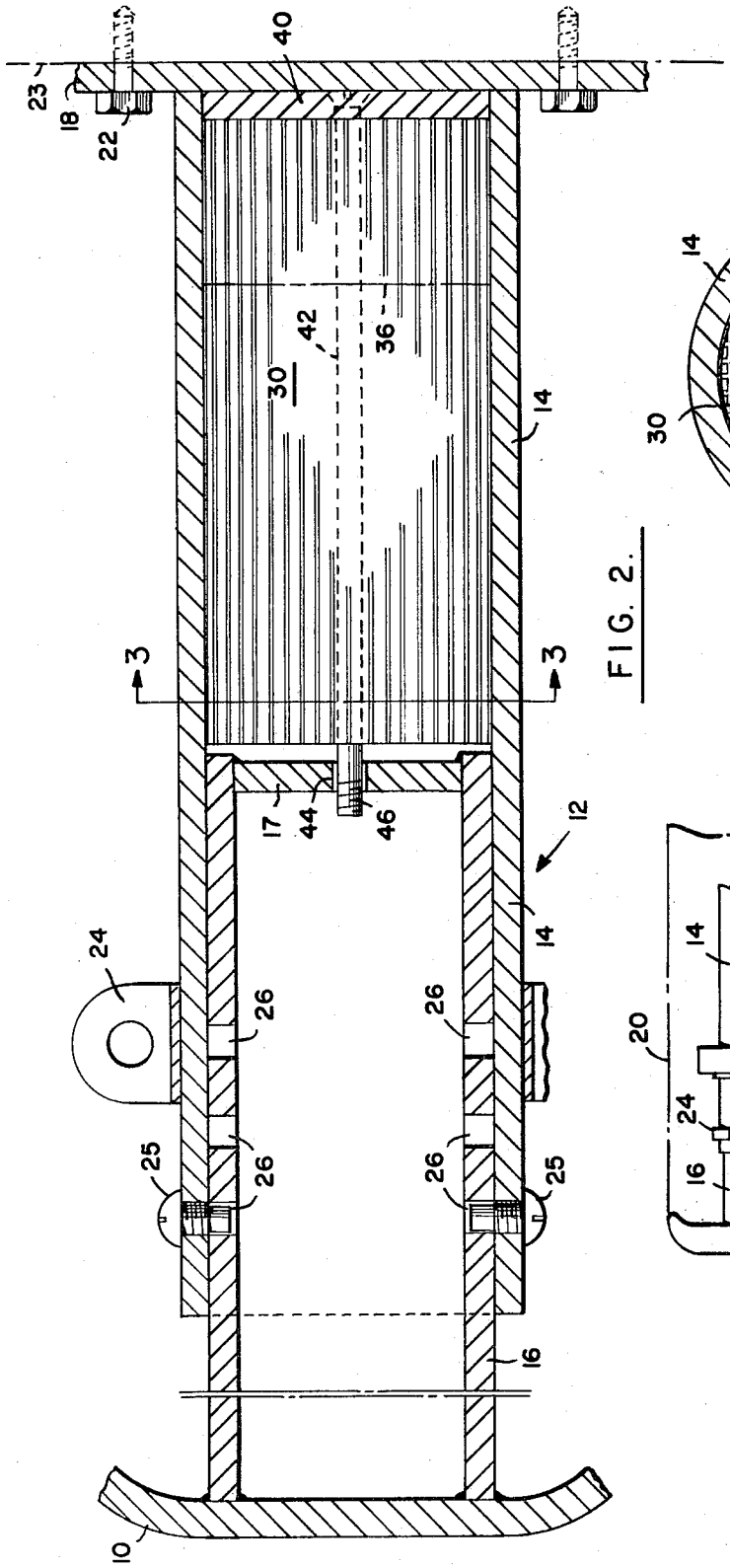


FIG. 2.

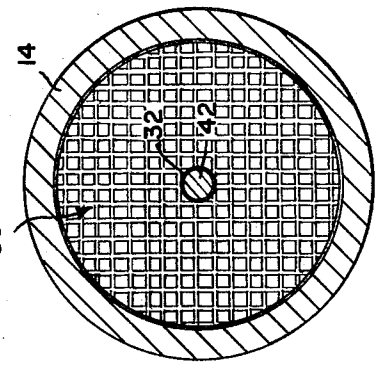


FIG. 3.

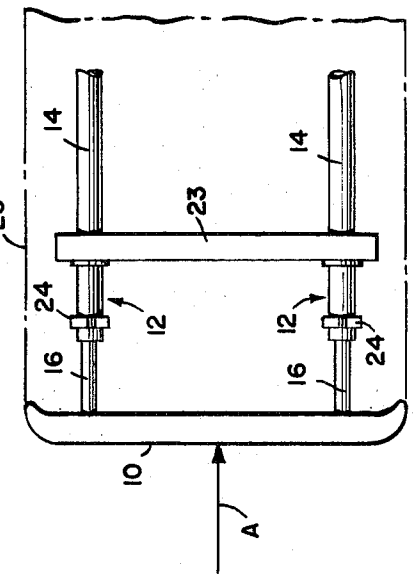


FIG. 1.

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FRANGIBLE BUFFER APPARATUS FOR VEHICLES

BACKGROUND OF THE INVENTION

This invention relates generally to an impact absorbing bumper apparatus for vehicles such as automobiles or the like. One of the problems in the construction of present day automobiles is that the bumpers are incapable of withstanding even minor collisions without the occurence of substantial damage to the automobile requiring expensive repairs. Accordingly, there is a great need for bumpers which can receive a collision impact and minimize the damage to the various parts of the automobile requiring repair.

SUMMARY OF THE INVENTION

It is the general object of this invention to provide a bumper apparatus for vehicles, such as automobiles, which is capable of absorbing the impact produced on the bumpers by collisions with the effect that damage to parts of the automobile is substantially minimized and to achieve this result at a minimum of cost.

Briefly stated, the objects of the invention are achieved by providing a bumper apparatus which includes a pair of telescoping members, one of which is connected to the bumper and the other of which is secured to the vehicle, and an energy-absorbing means, in the form of a cartridge comprising a crushable material, which cartridge is arranged to resist the inward movement of the bumper connected member relative to the other member in response to the application of an impact load on the bumper.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a plan view of the bumper apparatus in accordance with the invention as mounted on an automobile;

FIG. **2** is a sectional view of the bumper apparatus in accordance with the invention; and

FIG. **3** is a sectional view on lines **3—3** of FIG. **2.**

DESCRIPTION OF THE PREFERRED EMBODIMENT

The bumper apparatus in accordance with the invention comprises a bumper **10,** and two bumper supporting units **12** of similar construction, each of which comprises a pair of tubular members **14** and **16** telescopically mounted together with member **16** movably supported within member **14** as is best shown in FIG. **2.** The outer member **14** is secured at one end, as by welding, to a mounting plate **18** which is mounted on the front end of a vehicle **20,** such as an automobile, by means of mounting bolts **22** which engage the frame **23** of the vehicle. Also, support members or bands **24** attach the other ends of tubular members **16** to frame **23.** The member **16** has its extended end connected, as by welding, to the bumper **10** and its inner end closed off with an impact plate **17** for a purpose to be described more fully hereafter. The members **14** and **16** are held in a desired position by means of a pair of shear screws **25** which are threadedly secured in member **14** and extend into holes **26** in inner member **16.** There are provided two additional pairs of holes **26** spaced axially along member **16** to provide alternative mounting positions for the members **14** and **16.** The shear screws **24** serve to position member **16** relative to member **14**

under normal conditions but, as will be described more fully hereafter, will be sheared upon the application of an impact load to the bumper **10** permitting the member **16** to move relative to the member **14.**

Energy-absorbing means are provided for resisting inward or retracting movement of member **16** relative to member **14** in response to the application of an impact load on the bumper **10** in a direction to move the bumper **10** toward the vehicle **20** such direction being indicated by arrow "A" in FIG. **1.** This energy-absorbing means comprises a cylindrical cartridge **30** contained within tubular member **14** inwardly of the impact plate **17** at the end of telescoping member **16.** The cartridge **30** is designed to substantially fill this space so as to resist the inward movement of member **16.**

The cartridge **30** is made of what may be termed a non-resilient "crushable" material, this term being used herein as meaning a material which will reduce permanently in volume in response to the application of a load thereto throughout a substantial area of its surface, and which will not rebound because of the non-resiliency of the material selected. Illustrative examples of satisfactory non-resilient crushable materials are lead or resin-impregnated cardboard formed in a grid-like, a honeycomb or other cellular configuration. In FIGS. **2** and **3** there is shown a crushable cartridge **30** made of a grid-like construction. It will be apparent that the cartridge **30** is thus crushable from an initial volume to a reduced volume since the material forming the grid arrangement can be collapsed to a smaller volume by filling in the grid cavities or cells.

The cartridge **30** is designed to be replaceable and to this end, there is provided means for removing the cartridge after it has been crushed. It will be apparent that a crushed cartridge can be rather firmly embedded in the tubular member **14.** The cartridge removing means comprises a plate **40** movably contained within tubular member **14** and located between the inner end of cartridge **30** and the mounting plate **18.** A rod **42** is secured at one end, as by welding, to the plate **40** and extends axially therefrom through a central bore **32** in the cartridge **30** and through an opening **44** in the impact plate **17** to terminate at a threaded end **46.** It will thus be apparent that a cartridge **30** can be removed from member **16** by engaging the end **46** of rod **42** and pulling the same outwardly, this outward movement serving to extract the cartridge **30** by engagement of the remover plate **40** with the cartridge **30.**

In the operation of the bumper apparatus in accordance with the invention, the application of an impact load to the bumper **10,** as indicated by arrow A, will initially be resisted by the shear screws **24.** However, if the impact load is sufficient, such as in the case of a collision, the screws **25** will shear allowing the bumper units **12** and the bumper **10** to move inwardly toward the frame **23** of the vehicle. This inward movement will be resisted by the cartridge **30** of each unit **12** which are crushed by the pressure applied by the associated impact plates **17** of the movable members **16.** In effect, the cartridges **30** serve to absorb the energy produced by the impact load. It will be apparent that the impact energy is absorbed by the crushing action of the cartridge **30** which involves the deformation of the grid-like structure from the enlarged condition to a condition of reduced volume. This involves the permanent reduction in the size of the many cavities within the

cartridge as the cartridge is reduced in volume. The crushed condition of the cartridge is shown in FIG. **2** where the outboard end of the cartridge is shown in dashed lines at **36.** Typically, this would represent a reduction in length from about six to about two inches.

After impact, the bumper assembly, including bumper **10** and movable tubular members **16,** is slipped off the tubular members **14.** This makes the cartridge removing means accessible and a threaded handle is engaged with the threaded end **46** so that the rod **42** and the connected remover plate **40** may be readily pulled from the tubular member **14.** During this removing movement, the plate **40** engages the crushed cartridge **30** to extract the same from the tubular member **14.** A new cartridge **30** and the removing means are then reinserted into the tubular member **14** and the apparatus is reassembled as is shown in FIG. **2** with new shear screws **25** being installed.

The bumper apparatus made in accordance with this invention is adapted for mounting on the front and rear of an automotive vehicle.

It will be apparent that various changes may be made in the construction and arrangement of parts without departing from the scope of the invention as defined by the subjoined claims.

I claim:

1. A bumper apparatus for motor vehicles such as automobiles or the like comprising a bumper, a pair of elongated telescoping members, at least one of said members being tubular and being open at one end and one of said members being connected to said bumper, means for securing the other of said members to the vehicle to extend generally horizontally from the vehicle frame, energy absorbing means arranged to resist the inward movement of said one member relative to said other member in response to the application of an impact load to said bumper, said energy-absorbing means including a crushable cartridge which is reduced in volume in response to said relative movement of said members, means associated with said non-tubular member for delivering said impact load to said cartridge, said cartridge being insertable into and removable from the interior of said tubular member through said open end, and cartridge removing means within said tubular member at the time of application of said impact load for engaging said cartridge to forcefully remove the same from said tubular member when said cartridge removing means is withdrawn from said tubular member.

2. A bumper apparatus according to claim **1** including shearable means for holding said members in a predetermined position prior to the application of an impact load to said bumper.

3. A bumper apparatus according to claim **1** wherein said crushable cartridge is comprised of a cellular configuration, the cavities of which are permenently reduced in size when the cartridge is crushed to a reduced volume.

4. A bumper apparatus according to claim **1** wherein said means for removing said cartridge from said tubular member containing said cartridge includes a plate located at the internal end of said cartridge and a rod extending from said plate through said cartridge for access from the exterior of said tubular member containing said cartridge.

5. A bumper apparatus according to claim **4** including shearable means for holding said members in a predetermined position prior to the application of an impact load to said bumper.

6. A bumper apparatus according to claim **4** including shearable means for holding said members in a predetermined position prior to the application of an impact load to said bumper, said shearable means including at least one shear screw engaging each of said members.

7. A bumper apparatus according to claim **4** wherein said crushable cartridge is comprised of a cellular configuration, the cavities of which are permanently reduced in size when the cartridge is crushed to a reduced volume.

8. A bumper apparatus according to claim **1** wherein said crushable cartridge is comprised of a non-resilient cellular configuration, the cavities of which are reduced in size when the cartridge is crushed to a reduced volume.

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